GEI M1010-A

GE Energy

Motor Installation And Maintenance Instructions

Vertical AC Small Industrial Motors

NEMA 182 to 5011 Frame
NEMA Type P Base, Solid Shaft, TEFC
Normal Thrust and Aeration Pump Motors

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I. GENERAL INFORMATION

A. How to Properly Use this Instruction Manual

This installation and maintenance manual has been written to assist the user with proper procedures when handling, installing, operating and maintaining the equipment. All of the safety warnings and instructions in this book must be followed to prevent injury to personnel.

This manual must be kept for future reference during installation, operation and maintenance.

B. Safety Symbols

Below is a safety symbol table that identifies the safety symbols that appear in this manual and on the motors.

The use of a lightning bolt within an arrowhead symbol, enclosed in a yellow triangle warns of dangerous electrical voltage that could cause an electric shock to a person.

The use of an exclamation point within a yellow triangle indicates to the user that important installation, operating and maintenance instructions must be followed.

The use of wavy lines, enclosed in a yellow triangle, indicates that the motor can be hot and should not be touched without taking proper precautions.

This symbol instructs one to read the manufacturer's instruction manual before installation, operation and maintenance.

This symbol identifies a terminal, which is intended for connection to an external grounding conductor for protection against electric shock in case of a fault.

The use of a small case "i" enclosed in a square indicates a general note.

WARNING: Indicates a procedure or condition that, if not strictly observed, could result in personal injuries or death.

CAUTION: Indicates a procedure or condition that, if not strictly observed, could result in minor injuries to personnel.

This symbol indicates the need to wear hearing protection.

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C. Safe Motor Operation Information

***WARNINGS**: High voltage and rotating parts can cause serious or fatal injuries. Qualified personnel should perform installation, operation and maintenance of electrical machinery. For equipment covered by this instruction book, it is important to observe safety precautions to protect personnel from possible injury. Be sure to keep the installation and maintenance information for future reference. All warnings and cautions must be followed.*

Installation

- *Avoid contact with energized circuits and rotating parts.*
- *Avoid bypassing or rendering inoperative any safeguards or protective devices.*
- *Avoid use of automatic-reset thermal protection where unexpected starting of equipment might be hazardous to personnel.*
- *Avoid contact with capacitors until safe discharge procedures have been followed.*
- *Be sure the motor shaft key is captive before the motor is energized.*
- *Avoid long exposure in close proximity to machinery with high noise levels.*
- *When the motor is coupled to equipment, ensure that system vibrations are within acceptable limit (per ISO 10816-1) to avoid failure of the motor.*
- *Use proper protective gear, care and procedures when handling, lifting, installing, operating and maintaining the motor.*
- *If eyebolts are used for lifting motors, they must be securely tightened, and the direction of the lift must not exceed a 15° angle from the shank of the eyebolt. Do not use eyebolts in an ambient below 0°F. At temperatures below 0° F, the eyebolt could fail resulting in injury to personnel and/or damage to equipment. Drop-forged eyebolts per American Society of Testing Materials A489 or equivalent must be used.*
- *Do not use the motor shaft as a means for lifting.*
- *Do not lift both the motor and driven equipment with the motor lifting means.*
- *Do not stand on or place objects on the motor.*

Maintenance

Safe maintenance practices performed by qualified personnel are imperative. Before starting maintenance procedures, be positive that:

- *Equipment connected to the shaft will not cause mechanical rotation.*
- *Main motor windings and all accessory devices associated with the work area are disconnected from electrical power sources.*
- *The motor has been given time to cool.*

Failure to properly ground the frame of the motor can cause serious injury to personnel. Grounding should be in accordance with National and local Standards and consistent with sound practice.

These instructions do not purport to cover all the details in motors nor to provide for every possible contingency to be met in connection with installation, operation or maintenance. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to the General Electric Company.

This document contains proprietary information of General Electric Company, USA and is furnished to its customer solely to assist that customer in the installation, testing, operating and/or maintenance of the equipment described. This document shall not be reproduced in whole or in part, nor shall its contents be disclosed to any third party without the written approval of GE Energy.

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D. Description of Labels and Nameplates

Motor rating and identification data are furnished on labels and nameplates. Packing nameplates provide a permanent record of motor characteristics, plant identification and date of manufacture. Below is an example of a label that is attached to the shipping package.

MOD – GE model number
KW = Motor power rating
RPM = Motor speed at full load
VOL – Motor voltage
ENCL = Enclosure code
FR = Frame size
MASS = Motor mass

Figure 1: Packing Label

E. Model and Serial Numbers

As discussed in section D, every motor that is manufactured by GE Energy has a model and serial number, which are permanently marked on the motor nameplate. When contacting a GE Energy Service Shop or representative, please provide to the model and serial numbers.

Data and information regarding an individual motor model can be obtained from the Data Pack for the motor or through EliteNet or by contacting your local GE Energy representative.

F. Relevant Standards

1. Motors shipped with this installation instruction have been designed and built to the latest revision of the following standards:

   a. NEMA MG-1

2. Motors that have the IECEx designation have also been designed to meet the requirements of the following standards:

   a. IEC and/or BS/EN 60079-0
   b. IEC and/or BS/EN 60079-15

3. Motors with the CE Mark have also been designed to meet the requirements of the following EU directives:

   a. Machinery safety
   b. Low Voltage
   c. Electromagnetic Compatibility
   d. Conformity Assessment

II. RECEIVING

Each shipment should be carefully inspected upon arrival. Motor rating and identification data are furnished on a packing label for verification purposes. Any damage should be reported promptly to the carrier and a claim filed. The nearest GE Energy sales office may provide additional guidance.

A. Unpacking

If the motor has been exposed to low temperatures, unpack it only after it has reached the temperature of the room in which it will be unpacked. Otherwise the motor windings will be exposed to condensing moisture.

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B. Temporary Storage (Up to 6 Months)

If the motor will not be put into service immediately, certain precautions should be taken to protect the motor while in storage. **It is recommended the motor be placed under cover in a clean, dry location.**

During storage, windings should be protected from excessive moisture by some safe and reliable method of heating, such as space heaters, to keep the temperature of windings above the temperature of the surrounding air. It is recommended the motor in storage be inspected at periodic intervals, the windings meggered and a log kept of pertinent data. (Refer to the **OPERATION** section.) Any significant drop in insulation resistance should be investigated.

Precautions are taken by the factory to guard against corrosion. The machined parts are coated to prevent rust during shipment. If the equipment is to be stored, examine the machined parts carefully for rust and moisture and recoat where necessary.

The bearings of grease-lubricated motors are greased at the factory with the grease cavity approximately 50% full. Rotate the shaft of all grease-lubricated motors 10-20 revolutions at two-month intervals.

If the purchaser has specified the machine be packaged for long-term storage, the foregoing recommendations do not apply and the packing should be left intact during the period of storage.

C. Extended Storage (Longer than 6 months)

In the event the motor is to be stored longer than six months, please refer to GE instruction manual GEK-97427.

D. Handling

WARNING*: Lifting lugs on the motor are designed for handling only the motor. They are not to be used to lift the motor plus additional equipment such as pumps, compressors or other driven equipment. In the case of assemblies on a common base, lugs or eyebolts provided on the motor are not to be used to lift the assembly and base. The assembly should be lifted by a sling around the base or by other lifting means provided on the base. In the case of unbalanced loads (such as couplings or other attachments), additional slings or other effective means should be used to prevent tipping.*

III. Installation

WARNING*: Installation should be in accordance with the 'USA-National Electric Code' or 'BS/EN 60204-1' and 'BS/EN 60204-11' and consistent with sound National and local practices. Coupling, belt and chain guards should be installed as needed to protect against accidental contact with moving parts. Motors accessible to personnel should be further guarded by screening, guard rails, etc., to prevent them from coming in contact with the equipment.*

A. Location

Install the motor in a well-ventilated area. Make sure there is a minimum clearance of one foot around the motor to allow normal flow of air.

1. Drip-proof motors are intended to be used in a well-ventilated place reasonably free of dirt and moisture.
2. General Purpose enclosed motors can be used where they are exposed to dirt, moisture, and most outdoor conditions.
3. Severe-duty enclosed motors can be used in highly corrosive or excessively moist areas.

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4. Zone 2 Hazardous Locations

All motors marked with an IECEx or ATEX designation are suitable for Zone 2 locations. Before the motor is installed in the hazardous location, the marking must be reviewed for the intended location. If the motor marking does not meet the intent of the location do not install or operate the motor. Refer to BS/EN 60079-0 and BS/EN 60079-15.

Motor marking for IECEx will have a nameplate with the IECEx logo, IECEx certification number, and IECEx marking codes. An example of the IEC Ex marking is as follows;

Ex nA IIC T3 Gc

Where symbol:

a. Ex provides assurance of protection per IEC standards.
b. nA indicates non-sparking
c. IIC is a code to indicate the type of explosive gas atmosphere.
d. T3 is a code for the maximum surface temperature.
e. Gc is a code for the motor protection level.

Refer to B/EN 60079-0 and BS/EN 60079-15 for the meaning and understanding of all symbols and codes.

5. Division 1 Explosion-proof motors bearing the Underwriters' Laboratories label designating the motor's Class and Group as defined in the National Electrical Code (NEC) are designed for operation in areas classified by local authorities as hazardous in accordance with the NEC.

B. Mounting

1. The System Reed Critical frequency should be 25% above or below motor operating speed in order to avoid excessive vibration.
2. Mount the motor on a firm, level base. For base assembly and motor mounting, the mounting bolts must be tightened to prevent changes in alignment and possible damage to the equipment. It is recommended that a washer be used under each nut or bolt head to get a secure hold on the motor base. As an alternative, flanged nuts or bolts may be used. The recommended tightening torques for medium carbon steel mounting bolts, SAE Grade 5, are listed below in Table 1. For recommended tightening torques of other hardware on the motor see tables 4A, and 4B in the Tightening Torque section of this book.

Table 1

Bolt Size		Recommended Torque in Ft-Lb (N-M)			
Inch	Metric	Minimum		Maximum	
1/4	(M6)	7	(9)	11	(15)
5/16	(M8)	14	(19)	21	(28)
3/8	(M10)	25	(34)	37	(50)
1/2	(M12)	60	(81)	90	(122)
5/8	(M16)	120	(163)	180	(244)
3/4	(M20)	210	(285)	320	(433)

Note: For low carbon steel bolts, use 50% of the above recommended tightening torques. There are no ID marks on low carbon steel bolts.

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3. For direct coupled applications use flexible couplings if possible.

   Accurate mechanical lineup is essential for successful operation. Mechanical vibration and roughness in running the motor may be an indication of poor alignment. In general, lineup by straight edge across, and feeler gauges between coupling halves is not sufficiently accurate. It is recommended that the lineup be checked with a dial indictor and checking bars connected to the motor and load-machine shafts. The space between coupling hubs should be maintained as recommended by the coupling manufacturer. Shaft offset should not exceed 0.002". Angular misalignment should be less than 0.002".

4. The application of pulleys, sheaves, sprockets, and gears on the motor's shaft is shown in NEMA Standard MG1-14.07. The application of the V-belts dimensions for alternating current motors is in MG1-14.42. V-belt sheave pitch diameters should not be less than the values shown in Table 14-1 of NEMA MG-1. Sheave ratios greater than 5:1 and center-to-center distances less than the diameter of the large sheave should be referred to the Company. Make certain that the minimum allowed diameter of the motor pulley and the maximum belt tension are not exceed because an excessive pull may cause bearing trouble and shaft failures. Tighten belts only enough to prevent slippage. Belt speeds should not exceed 5000 feet per minute (25 meters per second). When V-belts are used, sheave ratios greater than 5:1 and center-to-center distances less than the large sheave shall not be used. The dimensions of the belt pulley are to be determined according to the kind of belt, transmission and capacity to be transmitted. Vent holes have to be kept free and required minimum distances are to be observed in order not to obstruct the flow of cooling air. In addition, make sure that the discharged hot air is not re-circulated into the motor.

C. Power Supply and Connections

1. Nameplate voltage and frequency should agree with the power supply. Motors will operate satisfactorily on line voltage within ±10% of the nameplate value or frequency within ±5%, combined variation not to exceed ±10%.

2. Dual voltage motors can be connected for the desired voltage using instructions on the nameplate or the connection diagram.

3. Wiring of motor, control, overload protection and grounding should meet the National and Local codes.

4. When mounting conditions permit, the conduit box may be rotated so that the conduit entrance can be made upward, downward, or from either side. For oversize conduit boxes, the mounting height of the motor may have to be increased for accessibility.

WARNING*: Motor and control overload protection and grounding should be in accordance with the USA -National Electric Code' or 'BS/EN 60204-1' and/or 'BS/EN 60204-11' and consistent with sound local practices.*

IV. OPERATION

A. Steps Prior to Starting

WARNING*: If the motor has been in a damp location, dry it out thoroughly before operating. Before energizing the motor for the first time or after an extended shut down, it is advisable to check the insulation resistance, power supply and mechanical freedom of the motor.*

In accordance with established standards, the recommended minimum insulation resistance for the stator winding when measured with a 500 volt DC direct indicating ohmmeter with self-contained power supply (megger), shall not be less than 5 mega-ohms at 40°C for a motor rated under 1000 volts, and not less than 100 mega-ohms at 40°C for a motor rated over 1000 volts. If the insulation resistance is lower than this value, it is advisable to eliminate the moisture in one of the following ways.

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1. Dry the winding in an air-circulating oven with the air surrounding the winding at 110°C, +5/-15°C until the part has been above 90°C for at least four hours. Then the air temperature may be raised to 150°C, +5°C/-15°C. Continue to heat until the insulation resistance is constant for a one-half-hour period.

2. Enclose the motor with canvas or similar covering, leave a hole at the top for moisture to escape. Insert heating units or lamps and leave them on until the insulation resistance is constant for a one-half hour period.

3. With the rotor locked mechanically and using approximately 10% of rated voltage, pass a current through the stator windings. Increase the current gradually until the winding temperature reaches 90°C. Do not exceed this temperature. Maintain a temperature of 90°C until the insulation resistance becomes constant for a one-half hour period.

B. Initial Start

WARNING: ***Be sure the motor is not running and the power supply is disconnected.***

Do not flush out anti-friction bearings. The bearing grease supplied is sufficient for initial operation.

1. Whenever possible, examine the interior of the motor for loose objects or debris which may have accumulated and remove any foreign material.

2. If possible, turn the rotor by hand to be sure that it rotates freely.

3. Check all connections with the connection diagram. Check all accessible factory made connections for tightness to make sure none has become loose during shipment.

4. When the driven load is likely to be damaged by the wrong direction of rotation, it is best to uncouple the motor from its load during the initial start and make certain it rotates in the correct direction. If it is necessary to change rotation, interchange any two line leads.

   Some motors are designed for unidirectional rotation. Rotation of these motors must be in accordance with the rotation indicated on the motor's nameplate and the outline furnished with the equipment. Connection plates on the motor have been furnished to assist in obtaining the proper rotation.

5. After inspecting the motor carefully, make the initial start by following the regular sequence of starting operations in the motor starter control instructions.

6. At initial start, the rate of rise of the bearing temperature is more indicative of trouble than is total temperature. When starting a machine for the first time, the bearing temperature should be observed for a minimum of 2 hours. If at any time the rate of temperature rise exceeds 2°C/minute, shut down the motor immediately and make an investigation of lineup conditions.

7. For anti-friction bearings check motor operation under load for an initial period of at least one hour to observe whether any unusual noise or hot spots develop.

8. In the event of excessive vibration or unusual noise disconnect the motor from the load and check the mounting and alignment.

9. Check the operating current against the nameplate value. Do not exceed the value of nameplate current multiplied by the motor service factor (if any) under steady continuous load.

10. Space heaters should be de-energized during motor operation.

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C. Jogging and Repeated Starts

CAUTION*: Repeated starts and/or jogs of induction motors greatly reduce the life of the winding insulation. The heat produced by each acceleration or jog is much more than that dissipated by the motor under full load. If it is necessary to repeatedly start or jog a motor, it is advisable to check the application with the local GE Energy sales office.*

V. MAINTENANCE

WARNING*: Before initiating maintenance procedures, disconnect all power sources to the motor and accessories. For motors equipped with surge capacitors, do not handle the capacitors until they are discharged by a conductor simultaneously touching all terminals and leads, including earth. This discharge conductor should be insulated for handling. Replace all normal grounding connections prior to operating.*

A. General

If the motor is dismantled during maintenance, sealing compounds (if any) shall be removed from machined rabbets (spigots). When reassembling the motor, all machined surfaces forming metal-to-metal joints should be sealed with watertight sealing compound (Tite-Seal, GE Spec. A50CD427A or equivalent).

Inspect the motor at regular intervals, depending on service. Keep the motor clean and the ventilation openings clear.

In addition to the daily observation of the overall condition, it is recommended that a general inspection routine be set up to check periodically the following items:

1. General cleanliness
2. Insulation and windings
3. Lubrication and bearings

B. General Cleanliness

The interior and exterior of the motor should be kept free from dirt, oil and grease and conducting dust. Paper, textile or dusts may build up and block off ventilation. Any of these contaminants can lead to early motor failure.

C. Division 1 Explosion Proof Motors

Division 1 Explosion-proof motors have special features and are manufactured in accordance with UL and carry its label. Therefore, repairs need to be made at a GE Service Shop, which has been authorized to make such repairs.

D. Insulation and Windings

To obtain a long life and satisfactory operation of insulated windings, they should be kept clean from dirt, oil, metal particles and other contaminants. A variety of satisfactory and acceptable methods are available for keeping the windings clean. The choice of method will depend greatly on time, availability of equipment and on the insulation system. Vacuum and/or compressed air cleaning with non-metallic hose tips should precede cleaning with water and detergent or with solvents. Tightly adhering dirt will require removal by gentle brushing or wiping.

WARNING: ***To prevent injury to the eyes and respiratory organs, safety glasses and suitable ventilation or other protective equipment should be used.***

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E. Vacuum and Compressed Air Cleaning

Compressed air should be used to remove loose dirt and dust from air passages such as air ducts. Suction should be used to remove dirt from the windings and to avoid damaging the coils.

	CAUTION: ***Care must be taken to make sure the air is dry and that air pressure of not more than 21 x $10^3 kg/m^2$ (30 psi)*** **is used.**

	WARNING: ***Operator must not use compressed air to remove dirt or dust from his or her person and clothing.***

F. Cleaning with Water and Detergent

This method is very effective in cleaning windings when used with a low-pressure steam jenny maximum steam flow 30 psi and 90°C.

	CAUTION*: To minimize possible damage to varnish and insulation, a fairly neutral non-conductive type of detergent such as DuBois Flow should be used. A pint of detergent to 76 liters (20 gallons) of water is recommended.*

If a steam jenny is not available, the cleaning solution may be applied with warm water by a spray gun. After the cleaning operation, the windings should be rinsed with water or low-pressure steam.

Dry the windings. Refer to the **Insulation Resistance** section in IV A. above, for instructions on how to proceed.

G. Anti-Friction Bearings and Lubrication

The grease used as a lubricant in grease-lubricated anti-friction bearings does not lose its lubricating ability suddenly, but over a period of time. For a given bearing construction and assembly, the lubricating ability of a grease over time depends primarily on the type of grease, the size of the bearing, the speed at which the bearing rotates and the severity of operating conditions. As a result, it is not possible to accurately predetermine when new grease must be added. But, good results can be obtained if the general recommendations stated in this manual are followed.

The primary function of grease is to supply the essential lubrication oil from the sponge-like reservoir of its soap structure. Grease-lubricated anti-friction bearings consume only a small amount of lubricant. This lubricant must always be present to avoid rapid wear and bearing failure. However, excessive or too frequent lubrication may also damage the motor.

Ball bearing motors are adequately lubricated at the factory. Motors with grease fittings should be lubricated in accordance with these instructions to provide maximum bearing life.

To obtain optimum results, Exxon Mobil Polyrex EM (General Electric Specification D6A2C23) polyurea grease should be used for lubrication, unless special grease is specified on the motor's nameplate.

See Section XI Lubrication Guide for greasing frequency and recommended quantity of grease. If in doubt, refer to GE Energy.

	CAUTION: ***Failure to use polyurea base (NLGI Grade 2) or known compatible grease could result in premature bearing failure.***

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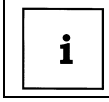
The procedure below must be followed for safe and effective re-greasing. The recommended frequency and quantity of grease is stated in tables 5 and 6.

WARNING*: Lubrication maintenance should be performed with the motor stationary and disconnected from the power source. Extreme caution must be exercised to avoid contact with rotating parts or electrical wiring if the motor must be lubricated while running. Extreme caution must be exercised to avoid contact with rotating parts or electrical wiring if the motor must be lubricated while running. Failure to observe these precautions may result in damage to the equipment, injury to personnel, or both.*

1. Run the motor until warm.
2. Stop the motor and disconnect it from the power supply.
3. Clean dirt and debris from around the inlet lubrication fitting and the grease relief plug.
4. Remove the relief plug and clean the opening and relief tube of hardened grease. This may be accomplished with a twisted wire brush or sturdy pipe cleaner.
5. Insert brush into the relief hole. While the motor is still warm, add grease with a hand-operated grease gun until fresh grease appears on the end of the brush or until grease has been added up to the amount listed in Table 6.
6. Leave the relief plug temporarily off. Start the motor and run for 10 to 20 minutes to expel any excess grease.
7. Stop the motor. Replace the relief plug.
8. Restart the motor and resume operation.

CAUTION: ***Failure to observe the foregoing instructions for re-greasing may result in grease leakage and/or bearing damage. To avoid damage to equipment, bearings and grease must be kept free of dirt.***

Because this method of greasing bearings tends to purge the housing of used grease over a period of time, removal of all grease should be required infrequently. A GE Energy Authorized Service Shop can clean the bearing cavity and replace the bearings and grease when the motor is removed from service for maintenance or reconditioning.



NOTE: ***Warranty may be voided if internal maintenance or repairs are not performed by a GE Energy Authorized Service Shop***

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VI. OPERATIONAL DIFFICULTIES

Some operating difficulties may occur. Common causes are given in Table 2 and should be corrected as soon as possible.

TROUBLESHOOTING CHART
Table 2

Affected Parts	Difficulty	What to Check
Windings	Overheating	Calibration of measuring instrument Excessive Current Unbalanced AC current Improper or restricted ventilation Excessive ambient temperature Short circuited coil or windings Dirty windings Unbalanced voltage
Bearings	Overheating	Calibration of measuring instrument Misalignment Excessive end thrust or radial loading Shaft currents Excessive or insufficient grease Worn out or dirty grease
Motor	Excessive Vibration	Unbalance Misalignment System Reed Critical frequency too close to the motor operating speed Improper or settled foundation Non-uniform air gap Rubbing parts Bent shaft Unbalanced stator current Damaged bearing
Winding Insulation	Low insulation resistance or insulation failure	Moisture, dirt, metal particles, oil, or other contaminants on the windings Wrong voltage Excessive temperature Voltage surges Mechanical damage Excessive vibration with resultant mechanical damage

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VII. FAILURE

WARNING: ***An extreme overload or electrical failure may result in heating or arcing which can cause the insulation to give off noxious fumes. All power should be removed from the motor circuit as a precaution even though the circuit has overload protection. Personnel should not approach the motor until adequate ventilation of the area has purged the air of fumes. When covers of a motor are removed after a failure, care should be observed to avoid breathing fumes from inside the motor. Preferably, time should be allowed for the motor to cool before attempting any examination or repair.***

WARNING: ***Water should not be applied to any electrically energized equipment because electric shock could result in serious or fatal injury. In case of fire, disconnect all power and use a carbon dioxide extinguisher to quench the flame. Before operating any motor after a suspected failure, it should be inspected for damage.***

VIII. REPAIR

If a motor is marked with IECEx or ATEX designation and repairs are required, the motor must be repaired by operators trained in the understanding of BS/EN 60079-1 and BS/EN 60079-15 standards. The motor has been designed to meet the rigid requirements of these standards. Repair or alteration of the motor may result in the motor no longer meeting the requirements of these standards. If major repairs are undertaken (such as rewinding a stator), proper facilities should be made available and suitable precautions observed.
Recommended tightening torques for various parts is listed in Tables 4A and 5B below.

WARNING: ***When burning off old insulation materials or when welding near insulation during rewinding, adequate ventilation must be provided to avoid exposing personnel to noxious fumes. Combustion of exhaust must be complete and adequately vented to the outside atmosphere in compliance with acceptable standards.***

Exposure of personnel to air-borne inorganic fibers must be avoided by adequate ventilation or by wetting the remaining insulation components following the burning of the organic materials.

IX. RENEWAL PARTS

The use of only GE Energy renewal parts is recommended. When ordering, specify the model number and the serial number of motor (complete nameplate data is desirable). Specify quantity and describe the part.

For information and service, refer to the nearest GE Energy Sales Office or a GE Energy Authorized Service Shop.

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X. TIGHTENING TORQUE FOR SAE HARDWARE

General Notes related to fasteners:

1. Medium carbon steel fasteners per ASTM A449 Type 1.
2. Stainless steel fasteners per ASTM F593.
3. Threaded holes in parts for fasteners are per System 21, ASME/ANSI B1.3

Table 4A: Tightening Torque Range
Medium Carbon Steel SAE Hardware Grade 5 (Unless specified in below table)

Screw/Bolt Size	Typical Application	Torque (Inch-lbs)	Torque (N-m)
#10 (Low Carbon Steel)	Bearing Cap	15 - 25	1.7 – 2.8
1/4 in (Low Carbon Steel)	Bearing Cap	35 - 60	4.0 – 6.8
1/4 in	All Parts, except Bearing Cap and Fan Cover	70 – 96	7.9 – 10.8
1/4 in Grade 8	Fan Cover Mounting	100 - 145	11 – 16
5/16 in	Bearing Cap	78 - 120	8.8 – 14
5/16 in	All Parts, except Bearing Cap	170 - 250	19 – 28
3/8 (Low Carbon Steel)	Conduit Box Cover	180 – 240	20 – 27
3/8 in	All Parts, except Conduit Box Cover	250 – 370	28 – 42
1/2 in	All Parts	610 – 920	70 – 100
3/4 in	All Parts	2150 – 3200	240 – 360

Table 4B: Tightening Torque Range
Stainless Steel SAE Hardware Property Class 50

Screw/Bolt Size	Typical Application	Torque (Inch-lbs)	Torque (N-m)
#10	Bearing Cap	15 – 25	1.7 – 2.8
1/4 in	Bearing Cap	35 – 60	4.0 – 6.8
1/4 in	All parts, except Bearing Cap	60 - 75	6.8 – 8.5
5/16 in	Bearing Cap	78 – 120	8.8 – 14
5 /16 in	All parts, except Bearing Cap	130 – 155	15 – 18
3/8 in	All Parts	230 – 275	26 – 31
1/2 in	All Parts	550 - 670	62 – 76
5/8 in	All parts	1100 – 1340	120 – 150
3/4 in	All Parts	2000 - 2360	230 - 270

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XI. Lubrication Guide

(Excerpt from: GEK-72836E)

Table 5: Motor Lubrication Guide

Type of Service	Typical Examples	HP Range	Lubrication Interval (Yrs.)
Standard	Machine tools, air-conditioning apparatus, conveyors (one or two shafts), refrigeration machinery, laundry machinery, oil well pumps, water pumps	1 – 7.5 10 – 40 50 – 150 200 – 1000	3 1 6 months 3 months
Severe	Motor for fans, MG- sets, etc., that run 24 hours per day, 365 days per year; coal and mining machinery; motors subject to severe vibration; steel mill machinery	1 – 7.5 10 – 40 50 – 150 200 – 1000	1.5 6 months 3 months 1.5 months
Very Severe	Dirty, vibrating applications; where end of shaft is hot (pumps and fans); high ambient temperature	1 – 7.5 10 – 40 50 – 150 200 – 1000	6 months 3 months 2 months 1 month

Table 6: Number of Grease Gun Pumps

Bearing Size on Motor Nameplate	Number of Pumps		Bearing Size on Motor Nameplate	Number of Pumps	
	16 Oz. Gun (Approx. 475 mL)	24 Oz. Gun (Approx. 700 mL)		16 Oz. Gun (Approx. 475 mL)	24 Oz. Gun (Approx. 700 mL)
6205	5	3	6312	40	27
6206	6	4	6314	50	35
6208	10	7	6315; C 2315	65	45
6210	25	17	6316	60	40
6213	35	23	6318; NU 318	75	50
6220	58	39	6320; NU 320; C 2320	95	65
6309	20	13	6321	153	102
6310	25	17	6324; NU324	246	164

NOTE: A standard 10,000 PSI (69 kPa) 16 ounce (475 mL) grease gun delivers approximately 0.04 oz. (1.18 mL) of grease with each pump, and a 24 oz. (710 mL) gun delivers approximately 0.06 oz. (1.77 mL) of grease. The number of pumps listed represents approximately 20% of the total grease cavity volume in end shield.

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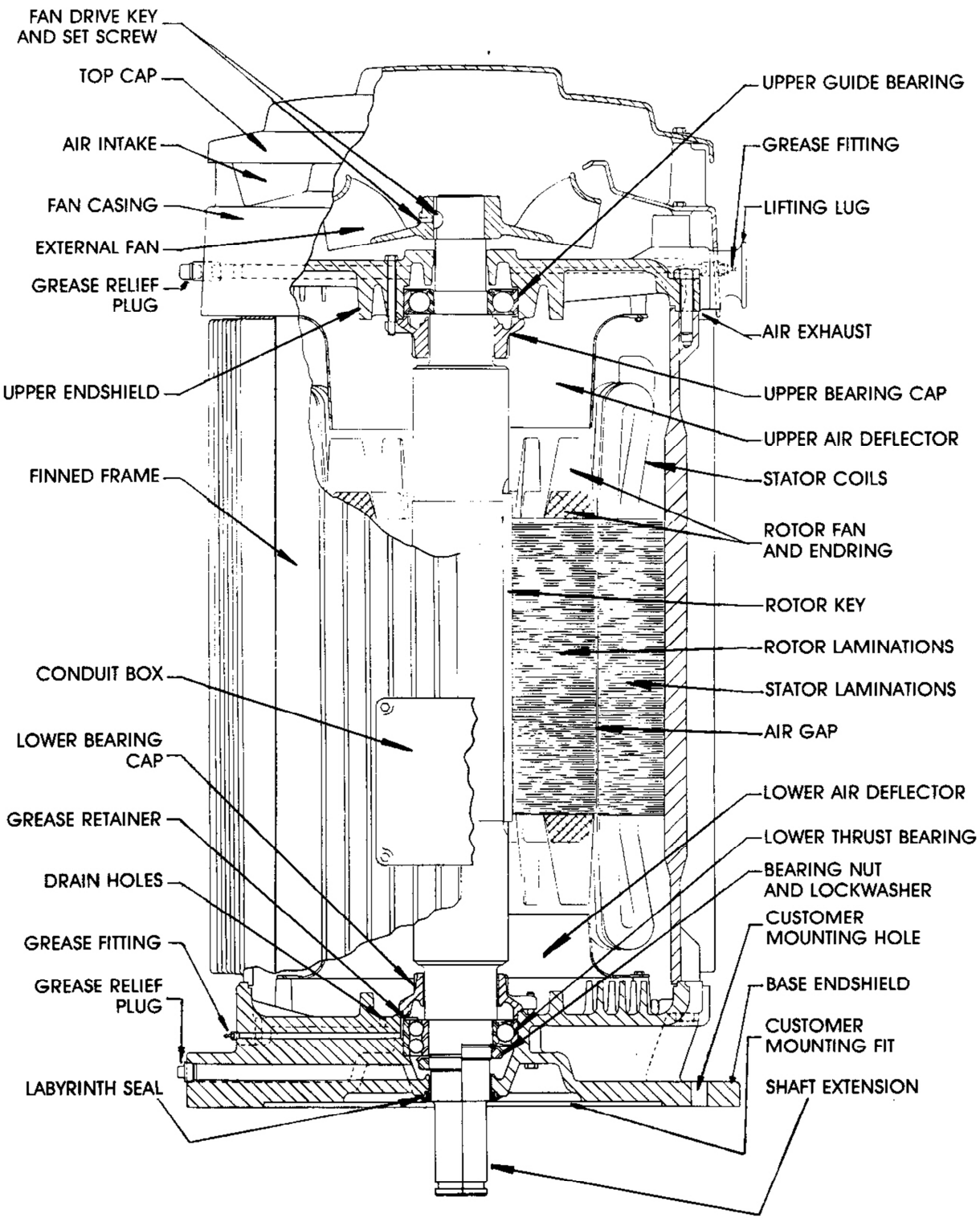

Figure 3

Typical Solid-Shaft Normal thrust TEFC Motor With Grease-Lubricated Ball Thrust And Guide Bearings. Double Row Thrust Bearing On Left Is Used In All Aerator Motors And In All 5011 Frame Normal thrust Motors

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